United Nations ECE/EB.AIR/GE.1/2015/19–ECE/EB.AIR/WG.1/2015/12

Economic and Social Council

Distr.: General
9 September 2015

English only

Economic Commission for Europe

Executive Body for the Convention on Long-range Transboundary Air Pollution

Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

Working Group on Effects

First joint session*
Geneva, 14–18 September 2015
Item 15 of the provisional agenda
Progress in activities in 2015 and further development of effects-oriented activities

Dynamic modelling**

Report by the Chair of the Joint Expert Group on Dynamic Modelling

Summary

The present report is submitted for the consideration by the first joint session of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe and the Working Group on Effects in accordance with the request of the Executive Body for the Convention on Long-range Transboundary Air Pollution in the 2014–2015 workplan for the implementation of the Convention (ECE/EB.AIR/122/Add.2 items 1.1.10, 1.1.11 and 1.3.13).

The report presents a summary of the progress in dynamic modelling of ecosystems effects by acidification, heavy metals and nutrient nitrogen including the interactions

* The Executive Body to the Convention agreed that, as of 2015, the Working Group on Effects and the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe should meet jointly, to achieve enhanced integration and cooperation between the Convention's two scientific subsidiary bodies (ECE/EB.AIR/122, para. 47 (b)).

** The present document is being issued without formal editing.

GE.15-15364(E)

between climate change and air pollution, biological responses and terrestrial carbon sequestration from the fifteenth meeting of the Joint Expert Group on Dynamic Modelling (Sitges, Spain, 29–31 October 2014).

I. Introduction

1. The fifteenth meeting of the Joint Expert Group on Dynamic Modelling under the Working Group on Effects (WGE) was held from 29 to 31 October 2014 in Sitges, Spain.

2. Twenty-two experts from the following Parties to the Convention on Long-Range Transboundary Air Pollution (LRTAP Convention) attended the meeting: Canada, the Czech Republic, Denmark, Finland, Germany, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom of Great Britain and Northern Ireland. The International Cooperative Programme (ICP) on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters), the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring), the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping), and the Bureau of the Working Group on Effects were also represented.

3. The meeting was chaired by Mr. F. Moldan (Sweden). It was organized by IVL Swedish Environmental Research Institute (Sweden) in co-operation with the Swedish Clean Air and Climate Research Program (SCAC).

II. Aims and organization

4. The aims of the Joint Expert Group (JEG) meeting were to examine progress in dynamic modelling of ecosystems effects by acidification, heavy metals and nutrient nitrogen including the interactions between climate change and air pollution, biological responses and terrestrial carbon sequestration. The aims were in accordance with the 2014–2015 workplan for the implementation of the Convention (ECE/EB.AIR/122/Add.2).

III. Conclusions and recommendations

5. The JEG appreciates the Swedish national programmes: SCAC and the Climate Change and Environmental Objectives (CLEO), which both focus on air pollution and climate and include analyses of the effects on ecosystems. These programmes offer an independent look at work done under the Convention with respect to dose-response relationships and links between emission-depositions and effects.

A. The effect of forestry practices and climate change on critical load calculations

6. There is an increasing need to take into account climate and land use practices in dynamic modelling (DM) projections of future ecosystem status. Climate change could either increase or decrease ecosystem susceptibility to acid deposition, through affecting a number of processes such as mineral weathering, organic matter decomposition and the water cycle.

7. The JEG noted that the increasing intensity of forest harvesting (e.g. increasing whole tree harvesting and use of branches and tops for energy production) potentially means less available capacity in the forest soils to counteract acidifying deposition and thus

lower critical loads. This means higher exceedance of critical loads at the same rate of deposition.

8. The JEG acknowledged that process understanding of links between forest growth, air pollution and climate needs to be conceptualised and implemented in models in order to simulate the future state of ecosystems. New empirical data on forest growth linked to climate and deposition were presented from the Czech Republic. Such data are also of utmost value for testing and development of models and for anchoring model predictions in reality.

B. Critical loads for terrestrial and aquatic biodiversity

9. The JEG welcomed the use of empirical observations and monitored data for model development and evaluation.

10. Several countries have made progress in assembling large empirical datasets on terrestrial biodiversity, and these are used to evaluate the effects of nitrogen (N) deposition on terrestrial biodiversity using steady-state approaches. The JEG also welcomed the use of empirical observations and trend data on soil solution, ground vegetation composition and nitrogen cycling for testing and evaluating models.

11. The JEG notes that despite progress in DM of terrestrial biodiversity, indices of biodiversity and models of biodiversity all need further development and improvements.

12. There is a need for definition of the reference conditions for biodiversity.

13. The JEG appreciates progress made on defining operational measures of biodiversity suitable for use in determining critical loads (CLs).

14. The JEG also noted with satisfaction progress reported from the Modelling and Mapping Task Force meeting held in Rome from 7 to 10 April 2014 on choosing the "habitat suitability index" as a measure for endpoint metric for biodiversity change. The habitat quality index might be good operational measure of "No net loss of biodiversity".

15. The JEG welcomed new development of the VSD+ dynamic model with respect to carbon (C) and N. To predict future N saturation is, however, still difficult.

16. The JEG notes a new call for data by the Coordination Centre for Effects (CCE) of the ICP Modelling and Mapping, including CLs based on plant diversity. Various countries will use different methodologies, which will at this stage not be harmonised.

17. The JEG urges all countries to address the call and to revise their CL calculations on the new finer spatial resolution.

C. Sources of uncertainty – critical loads and exceedances

18. The JEG welcomes the use of empirical observations and trend data on soil solution, ground vegetation composition and nitrogen cycling for testing and evaluating uncertainty in models.

19. The JEG points out that a series of workshops with experts to work out methodologies for determining CL for biodiversity would be very useful. These could be similar to those held at Skokloster in 1988 to develop the concept of CL.

20. To predict Future N saturation is however still difficult. Inability of models to capture transition from N-limited to N-saturated ecosystem poses large uncertainty in predicting future ecosystem N-status.

21. The JEG notes the discrepancy between EMEP modelled and measured deposition in some countries. This can lead to incorrect estimation of exceedances of CLs in the European maps prepared by the CCE. The result can be misleading messages to policymakers. From the maps it might appear that the acidification problem is solved, but the empirical data indicate that there are still significant areas in which CLs are exceeded. This becomes increasingly apparent as the deposition declines close to critical loads. The JEG urges EMEP to pay attention to these consequences of deposition estimates.

D. Ecosystem services and Natural Capital

22. The JEG recognizes that the effects of air pollution on ecosystems can be viewed in terms of "ecosystem services" or "natural capital". These concepts allow adverse effects on biological organisms (such as is done in determining critical loads) to be placed in larger social, economic and ecological perspective.

23. The JEG urges that the utility of ecosystem service models and natural capital accounting frameworks be evaluated, and appropriate approaches be integrated with current modelling efforts on the effects of the Convention.

24. The JEG recommends that the Convention consider defining a new long-term objective to prevent deterioration of natural capital or the decline of ecosystem services due to air pollution.

E. Progress in dynamic modelling of ozone effects on vegetation

25. The expert group noted that the interactive effects of N deposition and ozone on vegetation may (will) be important but need further exploration. More experimental data are necessary to evaluate conceptual understanding of ozone and nitrogen interactions and to construct dynamic models on the effects on ecosystems.

26. Coming meetings of the European Union project Interactive Effects of Nitrogen Deposition and Ozone (ECLAIRE) and the international Acid Rain conference in 2015 are very likely to shed more light on this issue.

F. Progress in dynamic modelling of heavy metals cycling in ecosystems

27. The JEG notes the need for additional research on modelling the biogeochemistry of mercury (Hg) to be able to predict future methyl mercury in fish.

28. The expert group notes with satisfaction the development of German maps of CLs for heavy metals. The group strongly supports this effort undertaken by Germany and urges more Parties to the Convention to follow this example and make efforts towards mapping critical loads for heavy metals.

G. Air pollution effects on ecosystems not previously considered

29. Nitrogen deposition can be a significant source of nutrients to coastal ecosystems and the cause of adverse effects. DM will be needed here to simulate the non-linear responses and the possible lag times between dose and response.

30. Possibilities to model impact of N deposition on coastal waters were noted. There was also a discussion on the potential to include impact of N deposition on the catchment (as opposed to deposition directly on water surface) in such modelling.

H. Recommendations

31. The JEG notes that despite progress in DM of terrestrial biodiversity, indices of biodiversity and models of biodiversity both need further development and improvements, and recommends to continue supporting such efforts.

32. The JEG also noted with satisfaction the progress reported at the Modelling and Mapping Task Force meeting in Rome on defining a "habitat suitability index" as an endpoint metric for biodiversity (change) and recommends further exploration of this concept.

33. The JEG concluded that it still is difficult to predict N saturation in terrestrial ecosystems. The expert group identified this inability of major concern also with respect to modelling biodiversity change. The time required to move from one ecosystem state of N richness to another is largely unknown. Thus the dynamics of the process of N saturation and thus changes in species composition remains elusive. The JEG recommended continued monitoring and execution of well-designed large-scale experiments to provide the much needed new insights to resolve this crucial question.

34. The JEG welcomed the plans for the Convention 2016 assessment report and the invitation to participate in preparation of the report. The JEG looks forward to receiving a draft of the report in advance of the sixteenth JEG meeting in October 2015, and envisions discussion of the report at the meeting. The assessment report should include aspects of dynamic modelling and in particular aspects related to ecosystem effects, time to recovery and the dynamic aspects of ecosystem change.

35. The Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol) and subsequent protocols are effects-based, and eventual future protocols should also be effects-based. Dynamic models are needed to predict future effects for given emission reductions under current and future protocols.

36. The JEG welcomed the WGE Trend Report to be prepared in 2015 and led by ICP Waters. The JEG looks forward to receiving the draft and having a presentation about that at the sixteenth JEG meeting. DM results may in this connection be used to predict future development.

37. The JEG considered the possibility of holding joint meetings with other WGE bodies, in particular with one of the ICPs. The group sees a value of continuing its activities under the current format. The discussions at JEG have led and still lead to increased understanding of the processes behind the ecosystem effects of air pollution, and DM offer possibilities of illustrating these effects.

38. The JEG discussed ways to get all ICPs represented at its next (sixteenth) meeting. In addition it would be beneficial to have representatives from the Task Force on Reactive Nitrogen (TFRN), the Working Group on Strategies and Review, EMEP, the Task Force on Hemispheric Transport of Air Pollution (TFHTAP) and the Task Force on Integrated Assessment Modelling (TFIAM). The group also discussed ways to strengthen co-operation with earth system modellers. Participation from countries currently not represented in JEG DM such as France, Poland and the countries of Eastern and South-Eastern Europe, the Caucasus and Central Asia would be beneficial.

39. SCAC is much thanked for co-organizing the 2014 JEG meeting.

IV. Future of the Joint Expert Group

40. Participation of all ICPs, TFIAM, TFRN, EMEP and TFHTAP will be actively sought to ensure that the information exchange between JEG DM and these bodies functions well. Furthermore, JEG DM will continue to seek participation from other research groups using dynamic models.

41. The JEG will also encourage modelling groups from countries not represented in JEG to consider their future participation.

42. The JEG will monitor progress in the ÉCLAIRE project (ends September 2015) and will also follow up new developments with the COST action on climate change experiments (CLIMANI).